Co_3O_4/SiO_2 Nanocomposites for Supercapacitor Application

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ABSTRACT

In this study, Co_3O_4/SiO_2 nanocomposites have been successfully synthesized by citrate–gel method by utilizing SiO_2 matrix for Co_3O_4 embedment. Spectroscopy analyses confirm the formation of high crystalline Co_3O_4 nanoparticles; meanwhile, microscopy findings reveal that the Co_3O_4 nanoparticles are embedded in SiO_2 matrix. Electrochemical properties of the Co_3O_4/SiO_2 nanocomposites were carried out using cyclic voltammetry (CV), galvanostatic charge–discharge, and electrochemical impedance spectroscopy (EIS) in 5 M KOH electrolyte. The findings show that the charge storage of Co_3O_4/SiO_2 nanocomposites is mainly due to the reversible redox reaction (pseudocapacitance). The highest specific capacitance of 1,143 F g^{-1} could be achieved at a scan rate of 2.5 mV s^{-1} in the potential region between 0 and 0.6 V. Furthermore, high-capacitance retention (>92 %) after 900 continuous charge–discharge tests reveals the excellent stability of the nanocomposites. It is worth noting from the EIS measurements that the nanocomposites have low ESR value of 0.33 Ω. The results manifest that Co_3O_4/SiO_2 nanocomposites are the promising electrode material for supercapacitor application.

KEYWORDS: Supercapacitor; Energy storage; Electrochemistry; Nanocomposites; Cobalt oxide

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